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Attorney Docket No. SIC-04-010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of:
TORU IWAI, et al
Application No.: 10/710,355
Filed: July 2, 2004
For: BICYCLE DISK BRAKE APPARATUS WITH LAMINATED COMPONENTS

Examiner: Bradley T. King
Art Unit: 3683

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

This is an appeal brief for the above-captioned matter.

I. Real Party In Interest

The assignee and real party in interest is Shimano, Inc., a Japanese corporation having a principal place of business in Osaka, Japan.

II. Related Appeals And Interferences

There are no prior or pending appeals, interferences or judicial proceedings known to the appellant, to appellant's legal representative, or to the assignee which may be related to, directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. Status Of Claims

Claims 3-5, 7-9, 13, 14 and 18-21 are pending under final rejection and are under appeal. Claims 1, 2, 6, 10-12, 15-17 and 22-25 have been canceled.

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IV. Status Of Amendments

No amendment was filed subsequent to final rejection.

V. Summary Of Claimed Subject Matter

The application discloses multiple embodiments of a bicycle disk brake apparatus with laminated components. Cited reference numbers and text are examples only and are not intended to be limiting. Line numbers refer to the line numbers within each individually cited paragraph.

As applied to independent claim 13, a bicycle disk brake rotor apparatus ((22), Fig. 2) comprises:

a hub mounting member ((22a), Fig. 2, page 4, paragraph [0020], lines 1-3);

a generally ring-shaped first rotor member ((90), Fig. 6A, page 5, paragraph [0022], lines 1-3) including a plurality of circumferentially disposed first fixing components ((90b), Fig. 6A, page 5, paragraph [0022], lines 4-6) extending radially inwardly from an inner peripheral surface of the first rotor member (90) and structured to mount the first rotor member (90) to the hub mounting member (22a) (Fig. 7, page 5, paragraph [0022], lines 9-12);

a generally ring-shaped first second rotor member ((91), Fig. 6B, page 5, paragraph [0022], lines 1-2 and 6-9) including a plurality of circumferentially disposed first fixing components ((91b), Fig. 6B, page 5, paragraph [0022], lines 6-9) extending radially inwardly from an inner peripheral surface of the first second rotor member (91) and structured to mount the first second rotor member (91) to the hub mounting member (22a) (e.g., upper position, Fig. 7, page 5, paragraph [0022], lines 9-12);

a generally ring-shaped second second rotor member ((91), Fig. 6B, page 5, paragraph [0022], lines 1-2 and 6-9) including a plurality of circumferentially disposed second fixing components ((91b), Fig. 6B, page 5, paragraph [0022], lines 6-9) extending radially inwardly from an inner peripheral surface of the second second rotor member (91) and structured to mount the second second rotor member (91) to the hub mounting member (22a) (e.g., lower position, Fig. 7, page 5, paragraph [0022], lines 9-12);

wherein each of the plurality of first fixing components (90b) on the first rotor member (90) aligns with a corresponding one of the plurality of first fixing components (91b) on the first second rotor member (91) (Fig. 7, page 5, paragraph [0022], lines 9-11);

wherein each of the plurality of first fixing components (90b) on the first rotor member (90) aligns with a corresponding one of the plurality of second fixing components (91b) on the second second rotor member (91) (Fig. 7, page 5, paragraph [0022], lines 9-11);

wherein the first rotor member (90) is pressure welded to and disposed between the first second rotor member (91) and the second second rotor member (91) (Fig. 7, pages 4-5, paragraph [0021], lines 5-6);

a plurality of fasteners ((22c), Fig. 7, page 5, paragraph [0022], lines 9-12) that fasten the hub mounting member (22a) to the plurality of first fixing components (90b) on the first rotor member (90), to the plurality of first fixing components (91b) on the first second rotor member (91), and to the plurality of second fixing components (91b) on the second second rotor member (91) (Fig. 7, page 5, paragraph [0022], lines 9-12) so that the first rotor member (90), the first second rotor member (91), and the second second rotor member (91) are sandwiched between the plurality of fasteners (22c) and the hub mounting member (22a) (Fig. 7) and so that the first second rotor member (91) and the second second rotor member (91) are pressed towards the first rotor member (90) with a compressive force by the plurality of fasteners (22c) and the hub mounting member (22a) to prevent delamination of the first rotor member (90), the first second rotor member (91), and the second second rotor member (91) from each other (Fig. 7, page 6, paragraph [0025], lines 4-6. Fig. 7 shows a fixing pin in the form of a conventional rivet that is press-deformed to form the structure shown in Fig. 7. Also, page 6, paragraph [0026], lines 9-10 state that the first and second fixing components (90a) and (91b) may be fixed to the tips of arms (117c) by a hexagonal head bolt (122c). Bolts create compressive forces on the components attached by the bolts.);

wherein at least a majority of the disk brake rotor apparatus (22) between outermost lateral side surfaces of the first rotor member (90), the first second rotor member (91) and the second second rotor member (91) at correspondingly same radial and circumferential locations thereof is free of voids; (In other words, voids are absent between correspondingly facing surfaces of the first and second rotor members (90, 91) for a majority of the disk brake rotor apparatus. While Fig. 7 shows a cross section of a part of the disk brake rotor apparatus (22), Figs. 6A and 6B show the

complete rotor members (90) and (91). When the fixing holes (90d) and (91d) are lined up during manufacture, all of the openings (90c) and (91c) align with each other to accomplish the ventilation effect mentioned at page 5, paragraph [0022], lines 1-3, so the remaining portions will be free of voids between their correspondingly facing surfaces.)

wherein the first second rotor member (91) is formed of a material having greater braking wear resistance than the first rotor member (90) (pages 4-5, paragraph [0021], lines 2-5);

wherein the second second rotor member (91) is formed of a material having greater braking wear resistance than the first rotor member (90) (pages 4-5, paragraph [0021], lines 2-5); and

wherein each of the plurality of first fixing components (90b) on the first rotor member (90), each of the plurality of first fixing components (91b) on the first second rotor member (91), and each of the plurality of second fixing components (91b) on the second second rotor member (91) is structured to receive at least one of the plurality of fasteners (22c) therethrough (Figs 6A, 6B and 7, page 5, paragraph [0022], lines 9-11).

As applied to independent claim 18, a bicycle disk brake rotor apparatus comprises:

a hub mounting member ((22a), Fig. 2, page 4, paragraph [0020], lines 1-3);

a generally circular first rotor member ((90), Fig. 6A, page 5, paragraph [0022], lines 1-3);

a generally circular first second rotor member ((91), Fig. 6B, page 5, paragraph [0022], lines 1-2 and 6-9);

a generally circular second second rotor member ((91), Fig. 6B, page 5, paragraph [0022], lines 1-2 and 6-9);

wherein the hub mounting member (22a) has greater thermal conductivity than the first second rotor member (91) and the second second rotor member (91) (page 4, paragraph [0020], lines 3-6; pages 4-5, paragraph [0021], lines 2-5);

wherein the first second rotor member (91) is formed of a material having greater braking wear resistance than the first rotor member (90) (pages 4-5, paragraph [0021], lines 2-5);

wherein the second second rotor member (91) is formed of a material having greater braking wear resistance than the first rotor member (90); (pages 4-5, paragraph [0021], lines 2-5)

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wherein the first rotor member (90) is pressure welded to and disposed between the first second rotor member (91) and the second second rotor member (91) (Fig. 7, pages 4-5, paragraph [0021], lines 5-6);

a plurality of first fixing components ((90b), Fig. 6A, page 5, paragraph [0022], lines 4-6) extending circumferentially around the first rotor member (90) and structured to mount the first rotor member (90) to the hub mounting member (22a) (Fig. 7, page 5, paragraph [0022], lines 9-12);

a plurality of first fixing components ((91b), Fig. 6B, page 5, paragraph [0022], lines 6-9) extending circumferentially around the first second rotor member (91) and structured to mount the first second rotor member (91) to the hub mounting member (22a) (e.g., upper position, Fig. 7, page 5, paragraph [0022], lines 9-12); and

a plurality of second fixing components ((91b), Fig. 6B, page 5, paragraph [0022], lines 6-9) extending circumferentially around the second second rotor member (91) and structured to mount the second second rotor member (91) to the hub mounting member (22a) (e.g., lower position, Fig. 7, page 5, paragraph [0022], lines 9-12);

wherein each of the plurality of first fixing components (90b) on the first rotor member (90) aligns with corresponding ones of the plurality of first fixing components (91b) on the first second rotor member (91) and the plurality of second fixing components (91b) on the second second rotor member (91) (Fig. 7, page 5, paragraph [0022], lines 9-11);

wherein at least a majority of the disk brake rotor apparatus (22) between outermost lateral side surfaces of the first rotor member (90), the first second rotor member (91) and the second second rotor member (91) at correspondingly same radial and circumferential locations thereof is free of voids; (In other words, voids are absent between correspondingly facing surfaces of the first and second rotor members (90, 91) for a majority of the disk brake rotor apparatus. While Fig. 7 shows a cross section of a part of the disk brake rotor apparatus (22), Figs. 6A and 6B show the complete rotor members (90) and (91). When the fixing holes (90d) and (91d) are lined up during manufacture, all of the openings (90c) and (91c) align with each other to accomplish the ventilation effect mentioned at page 5, paragraph [0022], lines 1-3, so the remaining portions will be free of voids between their correspondingly facing surfaces.)

a plurality of fasteners ((22c), Fig. 7, page 5, paragraph [0022], lines 9-12) that fasten the hub mounting member (22a) to the plurality of first fixing components (90b) on the first rotor member

(90), to the plurality of first fixing components (91b) on the first second rotor member (91), and to the plurality of second fixing components (91b) on the second second rotor member (91) (Fig. 7, page 5, paragraph [0022], lines 9-12) so that the first rotor member (90), the first second rotor member (91), and the second second rotor member (91) are sandwiched between the plurality of fasteners (22c) and the hub mounting member (22a) (Fig. 7) and so that the first second rotor member (91) and the second second rotor member (91) are pressed towards the first rotor member (90) with a compressive force by the plurality of fasteners (22c) and the hub mounting member (22a) to prevent delamination of the first rotor member (90), the first second rotor member (91), and the second second rotor member (91) from each other (Fig. 7, page 6, paragraph [0025], lines 4-6. Fig. 7 shows a fixing pin in the form of a conventional rivet that is press-deformed to form the structure shown in Fig. 7. Also, page 6, paragraph [0026], lines 9-10 state that the first and second fixing components (90a) and (91b) may be fixed to the tips of arms (117c) by a hexagonal head bolt (122c). Bolts create compressive forces on the components attached by the bolts.); and

wherein the hub mounting member (22a) comprises:

a centrally disposed hub attachment component ((40), Fig. 2, page 4, paragraph [0020], lines 3-6) structured to be mounted to the hub (17a); and

a rotor attachment component ((41), Fig. 2, page 4, paragraph [0020], lines 3-6) extending radially outwardly from the hub attachment component (40) (page 4, paragraph [0020], lines 6-7) and structured to mount to the plurality of first fixing components (90b) on the first rotor member (90), to the plurality of first fixing components (91b) on the first second rotor member (91), and to the plurality of second fixing components (91b) on the second second rotor member (91) (page 4, paragraph [0020], lines 9-10; page 5, paragraph [0022], lines 9-12).

VI. Grounds of Rejection to be Reviewed on Appeal

Claims 3-5, 7-9 and 13-14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Otomo (JP 2-679,162) in view of Shima, et al (JP 56-134,089).

Claims 18-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Otomo and Shima, et al in view of Seymour (US 6,343,675).

VII. Argument

Rejection under 35 U.S.C. §103(a) over Otomo in view of Shima, et al.

Claims 3-5, 7-9 and 13-14.

Otomo discloses a disk brake rotor (4) comprising a first rotor member (1) disposed between a pair of second rotor members (2). A plurality of attaching holes (5) are formed through disk brake rotor (4), and a cylindrical collar (7) is fitted in each attaching hole (5). A fastener (9) extends through each collar (7) to mount disk brake rotor (4) to a mounting member (not shown). Each collar (7) extends from the external side surface of one second rotor member (2) to the opposite external side surface of the other second rotor member (2). As a result, all pressing forces of fastener (9) are communicated through collar (7), so rotor members (1) and (2) are not pressed towards each other with a compressive force by the fastener and the hub mounting member to prevent delamination of the first rotor member and the first second rotor member from each other as recited in independent claim 13.

Shima, et al discloses pressure welding components of a disk brake together.

The final office action dated February 27, 2008 states, at the paragraph bridging pages 4-5, that Otomo's fasteners (9) are capable of pressing against the laminate to prevent delamination of the rotor. More specifically, since the collars are the same length as the thickness of the final rotor assembly, the collars would exert force should any separation occur. Such forces that resist movement of the rotors away from each other are considered by the examiner to be compressive forces since the forces are necessarily oriented in a direction forcing the rotors toward each other.

The forces referred to in the office action are forces that prevent additional movement of the rotor members away from each other once delamination has already occurred. By contrast, claim 13 recites a *compressive* force that *prevents* delamination from occurring in the first place, and it does so through fixing components that extend radially inwardly from the inner peripheral surfaces of the rotor members. The compressive force exists before delamination occurs. Furthermore, delamination does not inherently result in increased thickness of the components. It is only necessary to break the

bond between the laminated components. Delaminated components still can mesh together without an air gap between them. Indeed, brake rotor delamination typically is caused by the circumferentially-acting shear forces created by the application of the brake pads to the rotating rotor. The shear forces break the bonds between the rotor members and cause the rotor members to rotate relative to each other. In fact, this relative rotation causes wearing of the facing surfaces, thereby *lessening* the thickness of the rotor members.

In any event, because delamination of a laminated brake rotor is caused by circumferentially-directed shear forces rather than by forces that act perpendicular to the rotor surface, the claimed compressive force can help prevent delamination by resisting relative rotation of the rotor members, and it can do so by using fasteners that apply the compressive force at a location disposed radially inwardly from the actual braking surface. This surprising result is completely unrecognized by Otomo and Shima, et al.

Rejection under 35 U.S.C. §103(a) over Otomo in view of Shima, et al and Seymour.

Claims 18 and 21.

Otomo discloses a disk brake rotor (4) comprising a first rotor member (1) disposed between a pair of second rotor members (2). A plurality of attaching holes (5) are formed through disk brake rotor (4), and a cylindrical collar (7) is fitted in each attaching hole (5). A fastener (9) extends through each collar (7) to mount disk brake rotor (4) to a mounting member (not shown). Each collar (7) extends from the external side surface of one second rotor member (2) to the opposite external side surface of the other second rotor member (2). As a result, all pressing forces of fastener (9) are communicated through collar (7), so rotor members (1) and (2) are not pressed towards each other with a compressive force by the fastener and the hub mounting member to prevent delamination of the first rotor member and the first second rotor member from each other as recited in independent claim 13.

Shima, et al discloses pressure welding components of a disk brake together.

Seymour discloses a one-piece disk brake rotor mounted to a hub through a hub mounting member, wherein the hub mounting member comprises a centrally disposed hub attachment component and a plurality of radially extending arms.

The final office action dated February 27, 2008 states, at the paragraph bridging pages 4-5, that Otomo's fasteners (9) are capable of pressing against the laminate to prevent delamination of the rotor. More specifically, since the collars are the same length as the thickness of the final rotor assembly, the collars would exert force should any separation occur. Such forces that resist movement of the rotors away from each other are considered by the examiner to be compressive forces since the forces are necessarily oriented in a direction forcing the rotors toward each other.

The forces referred to in the office action are forces that prevent additional movement of the rotor members away from each other once delamination has already occurred. By contrast, claim 18 recites a *compressive* force that *prevents* delamination from occurring in the first place. The compressive force exists before delamination occurs. Furthermore, delamination does not inherently result in increased thickness of the components. It is only necessary to break the bond between the laminated components. Delaminated components still can mesh together without an air gap between them. Indeed, brake rotor delamination typically is caused by the circumferentially-acting shear forces created by the application of the brake pads to the rotating rotor. The shear forces break the bonds between the rotor members and cause the rotor members to rotate relative to each other. In fact, this relative rotation causes wearing of the facing surfaces, thereby *lessening* the thickness of the rotor members.

In any event, because delamination of a laminated brake rotor is caused by circumferentially-directed shear forces rather than by forces that act perpendicular to the rotor surface, the claimed compressive force can help prevent delamination by resisting relative rotation of the rotor members, regardless of where the compressive force is located. This surprising result is completely unrecognized by Otomo, Shima, et al, and Seymour.

Claim 19.

Claim 19 recites wherein the plurality of first fixing components on the first rotor member, the plurality of first fixing components on the first second rotor member, and the plurality of second fixing components on the second second rotor member extend radially inwardly from an inner peripheral surface of their respective first rotor member, first second rotor member and second second rotor member. This structure produces the surprising result that the claimed compressive force can help prevent delamination by resisting relative rotation of the rotor members by using fasteners that apply the compressive force at a location disposed radially inwardly from the actual braking surface. This result is completely unrecognized by Otomo, Shima, et al and Seymour.

Claim 20.

Claim 20 recites wherein the rotor attachment component comprises a plurality of arm components extending radially outwardly from the hub attachment component, wherein each arm component is fixed to a corresponding first fixing component on the first rotor member, to a corresponding first fixing component on the first second rotor member, and to a corresponding second fixing component on the second second rotor member. This structure produces the surprising result that the claimed compressive force can help prevent delamination without requiring a continuous circular flange structure. This result is completely unrecognized by Otomo, Shima, et al and Seymour.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

CLAIM 3. The apparatus according to claim 13 wherein the first rotor member has greater thermal conductivity than the first second rotor member and the second second rotor member.

CLAIM 4. The apparatus according to claim 13 wherein the first rotor member comprises aluminum, and wherein the first second rotor member and the second second rotor member each comprises stainless steel.

CLAIM 5. The apparatus according to claim 4 wherein each of the first second rotor member and the second second rotor member is formed with a hardening process.

CLAIM 7. The apparatus according to claim 13 wherein the first second rotor member and the second second rotor member are hot rolled to the first rotor member.

CLAIM 8. The apparatus according to claim 13 wherein the first second rotor member and the second second rotor member are forge welded to the first rotor member.

CLAIM 9. The apparatus according to claim 13 wherein the first rotor member has a thickness of from approximately 0.5 millimeters to approximately 1.5 millimeters, and wherein the first second rotor member and the second second rotor member each has a thickness of from approximately 0.2 millimeters to approximately 0.8 millimeters.

CLAIM 13. A bicycle disk brake rotor apparatus comprising:

a hub mounting member;

a generally ring-shaped first rotor member including a plurality of circumferentially disposed first fixing components extending radially inwardly from an inner peripheral surface of the first rotor member and structured to mount the first rotor member to the hub mounting member;

a generally ring-shaped first second rotor member including a plurality of circumferentially disposed first fixing components extending radially inwardly from an inner peripheral surface of the first second rotor member and structured to mount the first second rotor member to the hub mounting member;

a generally ring-shaped second second rotor member including a plurality of circumferentially disposed second fixing components extending radially inwardly from an inner peripheral surface of the second second rotor member and structured to mount the second second rotor member to the hub mounting member;

wherein each of the plurality of first fixing components on the first rotor member aligns with a corresponding one of the plurality of first fixing components on the first second rotor member;

wherein each of the plurality of first fixing components on the first rotor member aligns with a corresponding one of the plurality of second fixing components on the second second rotor member;

wherein the first rotor member is pressure welded to and disposed between the first second rotor member and the second second rotor member;

a plurality of fasteners that fasten the hub mounting member to the plurality of first fixing components on the first rotor member, to the plurality of first fixing components on the first second rotor member, and to the plurality of second fixing components on the second second rotor member so that the first rotor member, the first second rotor member, and the second second rotor member are sandwiched between the plurality of fasteners and the hub mounting member and so that the first second rotor member and the second second rotor member are pressed towards the first rotor member with a compressive force by the plurality of fasteners and the hub mounting member to prevent delamination of the first rotor member, the first second rotor member, and the second second rotor member from each other;

wherein at least a majority of the disk brake rotor apparatus between outermost lateral side surfaces of the first rotor member, the first second rotor member and the second second rotor member at correspondingly same radial and circumferential locations thereof is free of voids;

wherein the first second rotor member is formed of a material having greater braking wear resistance than the first rotor member;

wherein the second second rotor member is formed of a material having greater braking wear resistance than the first rotor member; and

wherein each of the plurality of first fixing components on the first rotor member, each of the plurality of first fixing components on the first second rotor member, and each of the plurality of

second fixing components on the second second rotor member is structured to receive at least one of the plurality of fasteners therethrough.

CLAIM 14. The apparatus according to claim 13 wherein at least one of the plurality of fasteners comprises aluminum.

CLAIM 18. A bicycle disk brake rotor apparatus comprising:

a hub mounting member;

a generally circular first rotor member;

a generally circular first second rotor member;

a generally circular second second rotor member;

wherein the hub mounting member has greater thermal conductivity than the first second rotor member and the second second rotor member;

wherein the first second rotor member is formed of a material having greater braking wear resistance than the first rotor member;

wherein the second second rotor member is formed of a material having greater braking wear resistance than the first rotor member;

wherein the first rotor member is pressure welded to and disposed between the first second rotor member and the second second rotor member; and

a plurality of first fixing components extending circumferentially around the first rotor member and structured to mount the first rotor member to the hub mounting member;

a plurality of first fixing components extending circumferentially around the first second rotor member and structured to mount the first second rotor member to the hub mounting member; and

a plurality of second fixing components extending circumferentially around the second second rotor member and structured to mount the second second rotor member to the hub mounting member;

wherein each of the plurality of first fixing components on the first rotor member aligns with corresponding ones of the plurality of first fixing components on the first second rotor member and the plurality of second fixing components on the second second rotor member;

wherein at least a majority of the disk brake rotor apparatus between outermost lateral side surfaces of the first rotor member, the first second rotor member and the second second rotor member at correspondingly same radial and circumferential locations thereof is free of voids;

a plurality of fasteners that fasten the hub mounting member to the plurality of first fixing components on the first rotor member, to the plurality of first fixing components on the first second rotor member, and to the plurality of second fixing components on the second second rotor member so that the first rotor member, the first second rotor member and the second second rotor member are sandwiched between the plurality of fasteners and the hub mounting member and so that the first second rotor member and the second second rotor member are pressed towards the first rotor member with a compressive force by the plurality of fasteners and the hub mounting member to prevent delamination of the first rotor member, the first second rotor member and the second second rotor member from each other; and

wherein the hub mounting member comprises:

a centrally disposed hub attachment component structured to be mounted to the hub; and

a rotor attachment component extending radially outwardly from the hub attachment component and structured to mount to the plurality of first fixing components on the first rotor member, to the plurality of first fixing components on the first second rotor member, and to the plurality of second fixing components on the second second rotor member.

CLAIM 19. The apparatus according to claim 18 wherein the first rotor member, the first second rotor member and the second second rotor member each comprises a ring-shaped member, and wherein the plurality of first fixing components on the first rotor member, the plurality of first fixing components on the first second rotor member, and the plurality of second fixing components on the second second rotor member extend radially inwardly from an inner peripheral surface of their respective first rotor member, first second rotor member and second second rotor member.

CLAIM 20. The apparatus according to claim 19 wherein the rotor attachment component comprises a plurality of arm components extending radially outwardly from the hub attachment component, wherein each arm component is fixed to a corresponding first fixing component on the first rotor member, to a corresponding first fixing component on the first second rotor member, and to a corresponding second fixing component on the second second rotor member.

CLAIM 21. The apparatus according to claim 20 wherein at least one of the plurality of fasteners extends through each associated arm component, through each associated first fixing component on the first rotor member, through each associated first fixing component on the first second rotor member, and through each associated second fixing component on the second second rotor member.

IX. EVIDENCE APPENDIX

1) Japanese Patent Application Publication No. 2,679,162 naming Otomo and entered into the record by the examiner in the office action dated June 30, 2005.

2) Japanese Patent Publication No. 56-134,089 naming Shima, et al and entered into the record by the examiner in the office action dated December 9, 2005.

3) U.S. Patent No. 6,343,675 issued to Seymour and entered into the record by the examiner in the office action dated June 30, 2005.

X. RELATED PROCEEDINGS APPENDIX

None